DOCUMENT RESUME

ED 443 095 CS 014 035

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TITLE Experiences in Collaboration: Development of an Interactive Hypermedia Program.
INSTITUTION International Reading Association, Newark, DE.
PUB DATE 2000-04-00
NOTE 18p.
AVAILABLE FROM http://www.readingonline.org.
PUB TYPE Reports - Descriptive (141)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Action Research; *Computer Software; *Educational Cooperation; Elementary Education; Higher Education; *Hypermedia; *Literacy; Program Development
IDENTIFIERS Interactive Model; Technology Integration

ABSTRACT

This paper describes the ways in which a number of individuals, including elementary school children, classroom teachers, and university faculty and staff, collaborated (initially through a literacy discussion group or LDG) over a number of months to develop an interactive hypermedia software program to improve students' literacy. The LDG approached the process of developing the software program as an opportunity for action research, and group members collected data and engaged in analysis to reflect on the processes involved in developing materials for classroom use and on the nature of their collaboration. The paper presents the contexts that led to the collaboration, the ways in which the participants worked together to develop the program, the themes of the collaboration, and suggestions for those considering collaborative projects. Contains 19 references. Attached are a timeline of program development, a look at challenges faced in program development, and information regarding decision making in program development. (NKA)

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Experiences in Collaboration: Development of an Interactive Hypermedia Program

By

Carolyn Ann Walker, Fuqiang Zhuo, Saundra E. Faris, Judy A. Abbott, Anita Nedeff, Ruth Oaks, Jaci Webb-Dempsey, Sarah Steele, Jane Rudden, Michelle Domas-Brown

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Experiences in Collaboration

Development of an Interactive Hypermedia Program

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Abstract

This article describes the ways in which a number of individuals, including elementary school children, classroom teachers, and university faculty and staff, collaborated over a number of months to develop an interactive hypermedia software program. The contexts that led to the collaboration, the ways in which the participants worked together to develop the program, themes of the collaboration, and suggestions for those considering collaborative projects are presented.

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Reading Online, www.readingonline.org
Posted April 2000

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ISSN 1096-1232

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In recent years, technology, particularly computer technology, has made an impact on educational practice in a number of areas and disciplines. While increasingly user-friendly hardware and software enable those who do not specialize in technology to use a variety of programs, the actual development of computer applications for use in specific contexts in education continues generally to require the expertise of individuals whose focus is technology.

In the past, this might have proven problematic, as collaboration between professionals from different disciplines and backgrounds was not viewed as a feasible part of staff development or as a practical approach to meeting the goal of improved student learning. Today, however, the value of collaboration within schools and between universities and schools has become apparent (Allison, Cristol, El-Amin, Garling, Hammond, & Pissanos, 1998; Oldfather & Thomas, 1998). Collaborative efforts involving teachers and librarians working with ESL students have reportedly yielded good results (Hurren, 1993). Teachers have found that working in collaboration with one another has positive effects that include increased levels of mutual respect and development of ideas for meshing differing instructional approaches for the benefit of students (MacIntyre, 1998). Benefits of university-school collaborations exist not only for students and preservice teachers, but also for school and university faculty. The results of some collaborations have included increased levels of insights and reflection on the part of school and university faculty, and in some cases changes in practice (Danielson, Kuhiman, & Fluckiger, 1998; Garcia et al., 1995).

Because collaboration can be multifaceted, it can provide a range of benefits and challenges to those who choose to engage in it. Collaboration can take many forms, draw upon a variety of its participants' resources and talents, and have unique and multiple meanings for those participants. This article describes the collaborative efforts involved in development of a hypermedia program for ESL instruction, and outlines the challenges, rewards, and insights experienced by those who participated in the collaboration.

A Context for Collaboration

This collaboration grew out of the weekly meetings of the Literacy Discussion Group (LDG), comprised of faculty from Central Elementary Professional Development School (Central PDS) and faculty, staff, and graduate students from West Virginia University. Formed in 1993, the LDG usually met on Wednesday afternoons for an hour to an hour and a half. (While the LDG continues to meet at West Virginia University's School of Education, Central PDS closed in the spring of 1999 due to decreased enrollment, and members of the group at the time of this collaborative project have moved to different locations.) For the project described in this article, group members also communicated by telephone and e-mail and engaged in casual discussions outside of school contexts. Special meetings were held at various stages of the collaboration.

One of the central purposes of the LDG was to provide an environment where members could freely and openly discuss literacy-related issues (Whitford, Schlechty, & Shelor, 1987). The hope was that members would work together to identify issues of mutual concern and come up with joint solutions (Barksdale-Ladd, Rudden, Oaks, Nedeff, Isenhart, & Johnson, 1994). The group engaged in inquiry related to both individual and group interests. Rather than selecting projects in which all members had equal stake, the group worked to address individual members' needs and concerns. Instead of diminishing the effect of participation in the group, this allowed members to interpret projects in ways relevant to their experiences.

The LDG acted from the stance that both members of the group and children at Central PDS should have a voice, and that learners should be active participants and decision-makers regarding their learning. This stance was the result of Central PDS faculty members' examination and discussion of practices they considered appropriate to a professional development school. The group's beliefs about literacy learning for native and non-native speakers of English were based on theories of authentic literacy learning and literacy learning as an active, constructive process (Teale & Sulzby, 1986).

During a fall 1994 meeting of the LDG, Anita, a Central PDS Title I (the compensatory education program funded

by the U.S. federal government) teacher and the fifth author of this article, suggested that the group consider developing a computer software program or activity for limited English proficient (LEP) students who needed assistance with learning English. Computer applications have been used successfully in English as a second language (ESL) classrooms (see, for example, Liaw, 1997; Schlessman-Frost, 1994). A number of languages besides English were represented at Central PDS, with Mandarin Chinese being the most common. Though support for all non-native speakers in learning English was offered in a number of ways, members of the LDG agreed that they were interested in the idea of a developing a computer software program that would focus on these children. At least one member was interested in pursuing inquiry related to computers and learning.

Based on these interests and the school demographics, the LDG began collaborating to plan a software project featuring Mandarin Chinese. Shortly thereafter, one member reminded the others that they were neglecting their position that children at Central PDS were to be viewed as decision-makers about their own learning. Although anxious to begin work on development of the software, the LDG decided that it was more important to gain the input of the children targeted to use the program. Thus began a collaborative project that grew beyond members of the LDG to include children at Central PDS and other faculty and graduate students at the school and a neighboring university. This project included initial inquiry, program development, program evaluation, and LDG reflection, which included the development of themes of the collaboration.

Broadening the Collaborative Group

Involving Children

The Literacy Discussion Group began gathering information by interviewing one Chinese child and her mother. The third-grade student stated that she could learn five to six words a day and that she learned words from friends on the playground. Group members decided they needed to gather information from more children about their English learning and their views of computers, so 10 primary and upper elementary native Chinese-speaking students were invited to share the ways in which they learned English. (The primary and upper elementary children were interviewed separately.) The children indicated that they preferred learning English in the classroom from a variety of individuals including their teacher. They also stated that they learned English while helping other students and that when they heard a Chinese text before an English version this helped them to learn English. These students also favored the use of computers in learning (Abbott et al., 1998).

During this time, the group also considered the types of reading and language experiences that might be included in a computer-related project. The group valued authentic literacy learning experiences such as book sharing (Holdaway, 1979; Teale & Sulzby, 1986) and decided to explore commercial, interactive, animated storybooks available for use on computers. Interestingly, no interactive, animated storybooks were available at that time in both Chinese and English. The group settled for multilingual versions of *Arthur's Teacher Trouble* (Brown, 1986) and *Just Grandma and Me* (Mayer, 1983), available in Japanese, English, and Spanish. Japanese-speaking children joined Chinese children asked to preview the commercial software and provide evaluative feedback on features that supported language learning and were viewed as engaging. Students who participated in the software preview clearly articulated their views of the commercial software programs and of hearing the stories read in both English and in a second language (Abbott et al., 1998).

After careful examination, reflection, and discussion about the information they had gathered, the LDG decided that the children's comments and reviews supported the development of a computer program and provided guidelines for the features to include. Consequently, group members developed a concept for an interactive, animated storybook available in both Chinese and English. Based on the children's recommendation, the LDG selected *There Was a Rabbit Named Bunny* a book written in both Chinese and English by Brenda Hsieh, a former Central PDS student. This book was the first created in the "Students As Authors" project at Central PDS, in which children wrote and illustrated books (Barksdale-Ladd & Nedeff, 1997; Nedeff, Brady, Maxwell, Oaks, & Seckel, 1994). The book also symbolized the transition between hard-copy stories and texts authored by the children on the computer, highlighting child empowerment at the school.

(Click here for a summary and more details of the children's participation in program development.)

Involving Other Faculty and Doctoral Students

Members of the LDG contacted Mike Reed, the director of the Teaching & Learning Technologies Center at the West Virginia University for assistance with software development. Mike, who has a history of supporting action research projects within professional development schools, provided hardware, software, and a location for the preview and evaluation of the program. Additionally, he suggested that Zhuo, a Chinese doctoral student majoring in instructional technology (IT) in the Department of Curriculum and Instruction (and second author of this article), serve as the programmer.

After Zhuo agreed to participate, the LDG met with him on several occasions, hoping to get software development quickly under way. Group members were surprised when they realized how much time would be required to do the programming. Tasks that appeared simple to them sometimes necessitated Zhuo's spending long and tedious

hours writing code. During this time he worked closely with Anita, who outlined the features desired by the children at Central PDS and by the LDG. Over the course of approximately 9 months, Zhuo and Anita worked, often side by side and sometimes with the whole LDG, to bring this hard copy child-authored bilingual book to animated interactive format using Authorware 4.0 (1995). When the programming was completed, the LDG previewed the result and offered feedback. After Zhuo completed some minor alterations, the program was ready for children to preview.

(Click here for a closer look at the difficulties faced at this stage of program development.)

The LDG invited several Chinese and two Japanese children from Central PDS to evaluate the program. Working in pairs, they explored the program's options and tried out its features, which included the ability to toggle between text in English and Chinese. The children also discussed their reactions to the program with members of the LDG (Abbott et al., 1998). As a result of the children's preview, the program underwent further minor modification. The final program included not only Chinese and English audio and visual text versions of *There Was a Rabbit Named Bunny*, but also interactive features such as "hot buttons" within the illustrations to provide written and pronounced vocabulary in both languages. The animated book also featured an option where users could write their own story based on the pictures. Pages of the program are available for viewing (with the QuickTime browser plug-in) by following the links on the On-Line Peer Tutoring page of Anita's area at the Online Multimedia Development Project website at West Virginia University.

From conception to completion, development of the animated story required nearly 18 months. Contributing to the length of this development period was the grade of the learning curve experienced by Zhuo and the LDG, and there were particular difficulties associated with the need to learn various programming intricacies within the actual process of creating the software. Another important factor in explaining the extended length of time required for completion was the number of participants involved in the project and the nature of the collaboration. Each of the many participants had a number of responsibilities in the collaboration, and work therefore had to occur over time and with careful scheduling.

(For an outline of the project's time line, presented in tabular form, click here.)

After evaluation and adjustments, the program was installed on the computer in the Title 1 classroom at Central PDS. There it was utilized not only with Chinese-speaking learners, but also with kindergarten and Grade 1 students who spoke other languages. Anita found that the Chinese students were especially excited about the experience of using the animated story, particularly when they heard their native language being spoken on the computer. Children who did not speak Chinese were also able to engage in the experience, and enjoyed hearing a new language. Anita continues to use the software with the LEP and English-speaking students at her current school, and two further student-authored stories are now being developed into interactive, animated computer programs.

Data Sources and Examination Procedures

The LDG approached the process of developing the software program as an opportunity for action research. Group members therefore engaged in data collection and analysis in an attempt to reflect on the processes involved in developing materials for classroom use and on the nature of their collaboration. Data were collected and examined in a number of ways throughout the project. The LDG kept notes of its meetings that focused on discussion, decisions, and plans. During the early stages of the project, data were collected from the semistructured interviews conducted with the children, and audio- and videotapes were made of the children as they previewed and evaluated both the commercial software and the program developed by Zhuo and the LDG (Abbott et al., 1998).

Data were examined at different stages of the development process, as new questions or aspects of the project arose. Transcriptions were made when appropriate, and group members discussed data as it was analyzed both thematically and qualitatively. Participants also provided personal written reflections on the collaborative project and process.

Themes That Emerged from Collaboration

The several themes that emerged through this collaboration fall into two general categories.

1. The Nature of the Collaboration

The themes in this category include layers of collaboration, the requirement to draw on the expertise of a number of people, shifts in leadership, and unevenness.

The layers of collaboration increased as the project developed. The collaboration began with the LDG and grew to

include Asian children at Central PDS, an IT professor at a nearby university, and a graduate student. It seemed that as the hopes and plans for the project grew, the need for support and assistance from others increased. As the LDG members worked with one another and also reached out to others, the collaboration began to feel like a community effort, but with the addition of each layer came an increase in collaborative complexity.

The individual expertise of all participants was required. Participants shared a common goal, but each brought her or his own expertise. Because its development was multifaceted, the program could not have been completed without the range expertise offered by individual participants. The LDG members were not technical or Chinese-language experts, but they provided expert knowledge of literacy development and an understanding of children's need to be actively involved in making decisions related to their learning. Zhuo provided knowledge of Chinese and expertise (not to mention determination) in programming. The children provided an important perspective regarding their learning needs and the appropriateness of the software.

Each member of the collaborative group freely contributed her or his expertise. Participants respected the expertise of others and gained from their interactions and work together as they gradually came to understand the complexity of developing this type of interactive software. As Anita commented,

> We embarked on this endeavor in the fall of 1994 thinking that at most we would be involved for two to three months. Those months extended much longer than we had planned. As I reflect on the whole project, I must say that the Literacy Discussion Group was really naive in attempting to design a project with so many facets, such as animation, sounds, and interaction, and to think that we could finish it quickly. As a group and as individuals, we had no experience with hypermedia, or with the ramifications of computer difficulties involved in trying to convert a hard copy text into a computer program. We learned early on that it was not as simple as scanning the book into the computer and then making it animated.

Leadership shifted based on needs. The leadership role included practical matters such as gathering materials and people for meetings, addressing the nature of group activities and program development, and collecting and evaluating information. As the layers of collaboration grew, individuals took on leadership roles as needed and as appropriate. Thus, leadership shifted among individuals based on expertise, interest, and time.

When children from Central PDS visited the university to preview and evaluate software, LDG members Jaci and Sarah provided direction and guidance. Both had expertise in evaluation related to West Virginia University's professional development schools and thus were able to provide valuable information about how to gather information from the children's activities. Literacy Discussion Group members who were teachers at Central PDS took a leadership role in gaining parents' permission for their children to participate in the previews and by providing transportation to the university. Their previous experience in arranging such matters in relation to field trips and other school-related activities was invaluable.

Children from Central PDS who were interviewed and who previewed and evaluated software also assumed a leadership role during the project. They were a strong force in guiding development of the animated, interactive story, as most of their preferences were included in the design of the program. The children indicated a desire for Chinese-to-English translation, colorful pictures, a slower narration rate, the availability of Chinese and English vocabulary to identify pictures, the ability to move between Chinese and English (which they did not want displayed in parallel because of the lack of one-to-one correspondence between the languages), the inclusion of sound effects, and the availability written and auditory definitions in both Chinese and English -- all of which were incorporated into the software. Only three preferences expressed by the children were not included: game-like features were avoided because LDG members believed these might distract children from the literacy focus of the project; vocabulary words were not placed around the border of the page because of technical complexities; and an oversight resulted in the omission of a written and audio reminder that the English-to-Chinese translation was not word for word but rather conceptual (Abbott et al., 1998).

During program development, Anita, who worked closely with many LEP students in her Title I class, assumed a leadership role by representing both the LDG and the children. For example, as mentioned previously, Zhuo at one point added some animated features he thought would make the program more appealing. Anita explained that these were not appropriate, based on the children's and the LDG's wishes. Carolyn and Judy, at that time both faculty members in literacy education at West Virginia University with experience in writing academic papers for presentation and publication, helped organize conference sessions and provided leadership in developing manuscripts about the collaboration.

By having many individuals involved in the collaboration, participants were able not only to tap into their own areas of expertise and interest but also to provide support and leadership at key times.

The collaboration was uneven. While all the participants in the collaboration put in many hours of work, these hours did not always occur in parallel or with other participants. Further, not all participants put in the same total hours. For example, Zhuo and Anita spent many hours working on programming during the summer of 1995, while other LDG members were participating in activities unrelated to the project. On the other hand, Zhuo did not participate in the weekly LDG meetings during the school year. The types of tasks and the hours spent on those tasks were different for each member of the collaborative group. Had individuals scrutinized the involvement and

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time commitments of others at different periods, they may have felt there was a lack of equity. Instead, participants for the most part focused on assisting in useful ways to get the project completed.

2. The Individual Experience of the Collaboration

The second general thematic category to emerge from analysis of the collaboration was the individual experience of the project. The themes in this category include time demands, emotional demands, and personal growth.

Time demands. The process of developing the program lasted 18 months, and we have now been sharing the project at professional conferences and through publication for 5 years. At times, it was difficult to coordinate the efforts of all of those involved and to accommodate project work within participants' busy schedules.

As Anita's earlier comment noted, the LDG did not initially appreciate that it would take more than a year to finish the project. Zhuo's comments reflect the frustration participants felt at this long development process:

> At the very beginning, I expected to get it done within the first summer session at the university. However, things were not as I assumed, and I made only a little progress for the first two weeks, even though I spent over 10 hours a week, perhaps even much more. The technical aspects of the project required problem solving throughout, and there were often times when elements of the program would not perform as expected.

As each problem was addressed, a new one seemed to arise, requiring new effort and time to solve. The result was that finishing the project seemed to grow more distant as time passed. One example was the difficulty involved in animating scanned images from the hard copy of the book. Neither the LDG nor Zhuo realized that this process would be so complicated and time consuming, and no one anticipated the several attempts and extensive problem solving that were required to complete this aspect of the program.

Emotional demands. Collaborators experienced a range of emotions over the course of the project. Individuals came to the project with their own notions of how to approach program development and evaluation. Sometimes, those notions meshed across the group, but sometimes there was conflict. And though a central tenet of the LDG was open discussion, these discussions among group members were not always easy or comfortable.

Disagreements occurred even as the project began, highlighting differences in belief systems among participants from different professional backgrounds. Specifically, elementary teachers Ruth, Anita, Jane, and other LDG members wanted to initiate project development with both personal reflection and the input of students. Carolyn, a university professor, had a more traditional "academic" view of project development and inquiry and believed a literature review and a more formal approach ought to be pursued. The resulting disagreement caused some frustration.

Some disagreements were directly and quickly addressed in group meetings, but some were not addressed until far later in the project. Carolyn described her experiences:

> Discussion about the computer project began around the time I joined the LDG. My participation in this group and in developing the program represented my first real experience as a university faculty [member] collaborating with teachers and elementary students. My prior experiences working with teachers included providing needed university services for use of a classroom to engage in inquiry. These experiences were successful and led me to believe I had knowledge of how to work with teachers. In the first months of my membership in the LDG a number of things happened to stir up some of my feelings about what it meant to work with teachers in developing projects and engaging in inquiry. For example, I found my voice was one of many and that being from the university did not afford me any more credibility than anyone else regarding inquiry. This was at times very frustrating, because I believed that my experience with inquiry was something I could really offer to the group. I also came to the group believing there was a sanctioned way to proceed with project development and inquiry. This sanctioned way included examining past inquiry in the field, forming questions and project development around previous inquiry, and following specific approaches in evaluating elements of the project. It wasn't so much that I, as the university person, believed that I had the answers, as that I believed there were criteria to be followed that would appropriately set up the inquiry and project development.

Other frustrations and anxieties arouse during project development. Zhuo explained his feelings about working with the LDG:

> Another challenging aspect of my participation in this project involved my interactions with members of the Literacy Discussion Group. Anxiety arose from the test of the pictures and sustained till the middle development phase. In addition to the uneasiness I felt about the unexplainable reason why the files would not open, I felt pressure because I knew that members of the LDG were very disappointed and perplexed. I saw that they discussed in very low voice away from me while a lab assistant and I struggled to unsuccessfully open the pictures. One of the LDG members asked a doctoral student who had done a wonderful Authorware program whether it was possible to go back to the scanning program to open a

> picture, and he said "Yes!" Every person knew that it was possible to load a file in an application program that created the file, but it did not work and at that moment we did not have a clue why. The only thing that we could say was that the file was corrupted or damaged. The question was why they worked in the previous week and did not work in the next week. Honestly, I had the idea that nobody trusted that I did the files correctly and I would be able to make it. I felt this especially after I heard that some of the LDG members said, "He said that he could do it...."

Participants worked to relieve the stress felt by others, however. Anita described working with Zhuo and finding ways to lessen pressure and frustration:

> As we spent time together and the weeks moved to months, we established a "comfort zone," in which we worked side by side without embarrassment or frustration. We were able to do this because we sought to clarify our misunderstandings, describe each other's perceptions of an issue, and define terms during each session.

Just as there were times of frustration, there were also times of satisfaction; as the program began to take shape, participants even felt a sense of delight and personal reward. Indeed, during the collaboration professional relationships sometimes turned to friendships. As participants worked together and overcame problems, they became more comfortable with one another and developed rapport based on their shared experience. Zhuo, for example, described his relationship with Anita:

> Although there were challenges and sometimes embarrassments associated with the programming, my relationship with Anita turned to friendship. Actually, this change was very natural because we met frequently and we came to know each other over time. We had numerous chances to discuss the difficulties and problems, and both of us tried to achieve the common goal -- a good educational hypermedia program.

Saundra, another doctoral student in the Department of Curriculum and Instruction, developed a friendship with Zhuo during the project as they shared their perspectives and professional interests.

At the end of the project participants felt a sense of accomplishment and pride in the finished product. Participants were also able to see that, even with uncomfortable moments such as those resulting from programming frustrations, the project was valuable and worthwhile.

Personal growth. Participants in the collaboration benefited in a number of ways. The Asian children from Central PDS who participated gained a sense of accomplishment and personal reward in working on a project that would help other students. This was a conscious desire on the part of the children, who stated specifically that the program could help children "because they would hear the English sounds and that it provided opportunities for writing" (field notes).

The relationship between Mike Reed, the director of the Teaching & Learning Technologies Center, and the LDG was mutually beneficial, and provided Zhuo with an opportunity for personal and professional growth. Mike provided the LDG with the technical support and expertise needed to complete the project, and the LDG provided Zhuo with a chance to work with teachers and students at an elementary school, thus fulfilling a requirement for his doctoral program. In his written reflections about the project, Mike indicated the following benefits for Zhuo:

1. Participate in a team approach to software development. This approach is typically found in industry but not found in higher education.
2. Engagement in the process of development of software and reflection on this process.

In his written reflections, Zhuo commented on his own experience of personal growth as he learned how to handle a variety of computer-related problems:

> Although I had learned Authorware and the scanning program before, the problems with this project placed new, unforeseen demands on me. I learned much through my participation in the project, though. For example, I learned how to handle a variety of computer-related problems relating to memory and program conflicts. enhance pictures with different programs bit by bit, create different animated layers in a page, and make all the sections of a large picture display at the same time. Also, I had to consider the portability of the program with Chinese characters included but not the Chinese software to go along.

Literacy Discussion Group members also became more familiar with technology, and some continued to pursue this interest. In her reflections, Anita wrote,

> The benefits of my participation in this project extend beyond the project itself. I have recently completed participation in the On-Line Multimedia Project through the Bell Atlantic Corporation. During the project, I learned to develop a personal project using HTML, scan pictures, create jif files, create buttons, and create QuickTime movies. My acceptance into the project, my participation in it, and my success in developing a multimedia project titled "Children's 'Language On-Line' for the World...Now!", the CLOWN Project, is a direct result of my participation with Zhuo in the designing and creating of the hypermedia program. After

> participating with Zhuo, I realized that I could become more involved with computers and enhance the learning of students through hypermedia.

Carolyn, at the time an assistant professor and a member of the LDG, learned that her views about inquiry and research were too rigid for the LDG; she also learned about action-based inquiry and child decision making and empowerment. She learned that inquiry based on the immediate needs of the participants and on questions related to ongoing practice was valuable both to the research community and to teachers, and she broadened her perspective beyond her prior experiences with more traditional forms of research. In her written reflections, she noted,

> As I struggled with this action-research approach, I moved somewhat away from the LDG emotionally and physically. Eventually, I came back to the group and came to realize that my prior experiences working with teachers were not truly collaborative, but rather a barter system (Olson, 1990). It took time, though, for me to understand as well as accept an approach that was so different than my previous experiences, and to realize that the collaborations in this action-research project provided an alternative yet a very much appropriate path of inquiry.

Reflections and Suggestions

Collaborative projects such as the one described in this paper can be very rewarding, but they can also provide a number of challenges and obstacles. The following suggestions might be useful for those considering collaboration.

1. Network with Other Educators to Pool Resources and Expertise

Participants from a public school and a university worked together to complete this project. Because of the established relationship between Central PDS and the university through the LDG, it was possible for the group to come together and share resources and expertise. While many individual schools may not be close to a university, they are often close to each other. Contacts with teachers from different schools can be made through e-mail, postings to electronic bulletin boards, and announcements at faculty meetings. Teachers with similar interests and experiences can share expertise and ideas through e-mail discussions, in-service meetings, or special interest groups such as the LDG. Through such contacts, teachers can accommodate one another's needs, seek additional resources, and work within a team to answer questions and solve dilemmas.

2. Share Tasks and Determine Roles

The collaborative project described here included a variety of tasks, some of which were very complicated. It is likely that one person could not have completed it. Because the collaborative group shared the tasks, they were more manageable than they would have been for even two or three collaborators. Task sharing can often make levels of individual responsibility reasonable while at the same time increasing the feeling of support involved in a group effort. In the collaboration described in this article, tasks were occasionally more manageable for some than for others, but through discussion about the project, participants had a sense of what their role was.

3. Be Flexible about Time

Before beginning a collaboration, it is wise to determine how flexible participants are regarding the total amount of time that it might take to complete a project. Although issues of time were not a major concern for the collaborative group described here and they were not discussed prior to the project's beginning, they could easily have become a problem as the software development process lengthened beyond original expectations.

Participants were also flexible about the amount of time individual members spent on the project. Rather than tallying up hours and comparing involvement, participants welcomed the help each provided. Those engaging in collaboration need to consider how comfortable they are when collaborators devote uneven amounts of time -- something that is likely to happen in a group whose members all have different demands on their schedules.

4. Communicate Needs and Concerns

It is important to be able to talk with others in a collaborative group and to share concerns. It takes time to become comfortable enough to do this. It was sometimes easy and other times more difficult for the LDG members and other collaborators to express their concerns, feelings, and frustrations. For example, when Zhuo began programming, he did not feel that he could communicate openly with Anita because he viewed her as his superior. Over time, he and Anita developed a friendship and were more comfortable about exchanging thoughts and opinions. Other collaborators also came to know one another better during the project through informal occasions and discussions. A feeling of camaraderie developed that seemed to create a bond between participants and an increased candidness.

Perhaps collaborators would benefit from getting to know one another. Participants might take time prior to starting

a project to develop rapport, or might make opportunities during collaboration for social events and informal discussion.

5. Include the Voices of Those for Whom the Project Is Intended

When engaging in collaboration, it is important to consider the perspectives of those for whom the project is intended. Traditional models of instruction support a more top-down approach to learning in which decisions about what is to be learned and how are made by someone other than the learner (Shannon, 1994). A more empowering view for learners supports them as active participants in decision making about their learning. It is useful to talk with, interview, and include in decision making those for whom educational collaborations are intended so that their voices and preferences will be included.

Sometimes it seems amazing to us that more than 20 individuals (including adults and children) were able to work together to complete the program described here. Yet at the same time, it was precisely the enormous effort of such an extensive collaboration that made the project a success. And this success was not just the tangible final product of the hypermedia program -- it was the success of learning about new things, learning to reflect on personal beliefs and practices, and working with colleagues and children.

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Reading Online, www.readingonline.org
Posted April 2000
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Timeline of Program Development

Fall 1994	Winter 1994-95	Spring 1995	Summer 1995	Winter 1995-96
LDG begins discussion Interview of 1 Chinese-speaking child and her mother	Interviews of several Chinese-speaking children Preview of commercial software by several Asian children	Zhuo selected as programmer	Programming begins	Programming completed Program evaluated by several Chinese-speaking children

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A Closer Look at Challenges Faced in Program Development

The process of developing the software was a long one, in part because all of us were learning what to do as we did it. Jim, the programmer, met with Ann every week throughout development. She was not interested in deadlines, however, but rather wanted the program to be developed well.

Only a little progress was made for the first 2 weeks, even though more than 20 were spent on the project in this period. One unexpected problem was the poor quality of the pictures scanned from the book. The programmer had to seek the help of the technical staff in the computer laboratory and rescan each picture in high resolution, which resulted in a little better quality and a larger file size for the images. Some of the individual files were too large to fit on a standard 2 MB high-density disk. The result was that the scanning and saving of pictures itself became a very time-consuming process.

Soon after, we experienced technical problems with hardware and software. None of the picture files, either those already imported into the authoring tool or those stored simply as images, would open. A change had to be made: files needed to be kept small and retrievable, even though this resulted in a somewhat poorer quality. Due to frequent computer freezes and crashes and lack of overall memory, use of the authoring program was often frustrating and slow; at other times, software wouldn't open as it ought to have.

Although Jim was familiar with Authorware and the scanning program, he faced a number of new and unforeseen demands with this project that may have lengthened it or at least made it more stressful. One challenge was interactions with members of the Literacy Discussion Group. Jim knew that LDG members were professors and teachers and felt that they were above him because he was a student. This feeling increased when his advisor told him that the Title I teacher (Ann) was his "boss," and that a good job of collaboration was expected. Jim was working on the project to earn a grade, and this contributed to the pressure he felt.

There were other challenges in project development and collaboration. As a non-native English speaker, Jim sometimes misunderstood what the LDG wanted the program to do. For example, the LDG asked that one of the book's pictures of Bunny be animated in such a way that its ear wiggled. Jim animated the ear, stretching it and making it fly around the screen in a way reminiscent of Pinochio's nose in the Disney cartoon. This was not what the group had in mind, as they very vocally let him know during the next meeting. He also created more animation, vocabulary, and audio for the program than were required, thinking that these additions would enhance the program. The LDG asked that they be

deleted as they were not specified as important to the book or in accordance with the students' wishes.

Not only were there software and programming challenges, but as collaborators worked together it was sometimes challenging for them to find a balance between sensitive and effective communication and the demands of the project.

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Specific Information Regarding Decision-Making in Program Development

Several Asian children were involved in the 5-month phase of initial design of the software program. They participated in conversations, structured and semistructured interviews, and previews of commercial software packages. Participation and decision-making by these students came layer by layer, and because of the natural attrition rate of Asian children at the school, not all children participated in all activities.

First, one child and her mother were interviewed and asked how the child learned English. The child suggested a number of methods, including practice on the playground. Her mother indicated that she felt if the child marked words in a written text and asked for help, she would learn English.

The LDG then interviewed six Chinese students from grades 1 to 3 and four from grades 4 to 6. Questions regarding the ways in which these children learned English as well as their familiarity with computers were asked. The younger students indicated a preference for learning English in the classroom and said they did not mind helping others with English as it offered benefits including making new friends and gaining the respect of American children. These children indicated they were familiar with computers and had gained most of their experience using their parents' computers.

The older children indicated a number of techniques that helped them learn English, including teaching another student, coauthoring English and Mandarin picture dictionaries with another Chinese child, and reading simple stories before more complicated ones. This group listed a number of positive attributes of computer programs including sound options and English pronunciation of words. They felt a voice-activated computer that said the word and showed the picture would be helpful.

Next four Asian children were asked to preview commercial software and were then interviewed. A protocol that focused on the general experience of using the computer and the specific experience of using the commercial software was used. Children made positive comments about the programs and also made suggestions, including letting the student read the text first, and then providing a read-aloud.

Before software development began, LDG members examined all the data and both common and specific responses were considered. Qualitative analysis occurred as participants reviewed data individually, discussed the data informally, and prioritized

information.

The following suggestions from the children were included in program design:

- Include two languages in the program -- English and Mandarin Chinese
- Include selected vocabulary in written and audio form for both languages
- Provide a means for the user to move between the two language options
- Provide a means for the user to select the order in which illustration only, English version, and Mandarin version would be viewed

Some suggestions from the children were not included due to constraints in programming capability or because they lacked educational focus.

After the program was completed, 13 children previewed and evaluated it. Children worked in pairs to explore the program. Following their engagement with the software, they participated in structured interviews. Suggestions for future software development included providing the capacity for users to write in Mandarin Chinese, and of creating programs for other languages so more students at the school could benefit.

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